

— FOR VALIDATION PURPOSES —

Work Order ID 134573

134573

July-09-15 10:22:02 AM

Page 1

Item ID: D6021-125

Accept

N900040100

Setup Start *NS1*

Revision ID:

Stop *NS2*

Item Name: Crosstube Material - 17-4Ph SS

Start Date: 7/09/15 Start Qty: 2.00

2

Cust Item ID:

Required Date: 7/21/15 Req'd Qty: 2.00

2

Customer:

Reference:

Approvals:

Process Plan:

Date:

Tooling:

Date:

Run Start *NR1*

QC:

Date:

SPC (Y/N):

Date:

Stop *NR2*

Sequence ID/ Work Center ID	Operation Description	Set Up/ Run Hours	Tool ID	Tool #	Plan Code	Accept Qty	Reject Qty	Reject Number	Insp. Stamp
--------------------------------	--------------------------	----------------------	---------	--------	--------------	---------------	---------------	------------------	----------------

Draw Nbr

Revision Nbr

D6021

A

100

0.00

100

PURCHASING

Purchasing

Memo

0.00

Purchasing

Issue P/O:

29073

Description: 17-4PH H1100 seamless Stainless steel Tube, per ASTM A564
2.378"OD X 2.00" ID X 125" Long)

Tolerance on all dimensions are as per Dwg D6021

Possible Supplier: ~~Standard~~

VU-14064001

Material certification is required

W 15.07.09

110

Receive & Inspect for Damage & Mat'l Certs

0.00

110

Packaging

Memo

0.00

Packaging

Ensure material certification is attached

2x 80 15-08-14

Work Order ID 134573

July-09-15 10:22:02 AM

134573

Page 2

Item ID: D6021-125

Accept

N900040100

Setup Start

NS1

Revision ID:

Item Name: Crosstube Material - 17-4Ph SS

Stop

NS2

Start Date: 7/09/15 Start Qty: 2.00

2

Cust Item ID:

Required Date: 7/21/15 Req'd Qty: 2.00

2

Customer:

Reference:

Approvals:

Process Plan:

Date:

Tooling:

Date:

Run

Start

NR1

QC:

Date:

SPC (Y/N):

Date:

Stop

NR2

Sequence ID/
Work Center ID

Operation
Description

Set Up/
Run Hours

Tool ID

Tool #

Plan
Code

Accept
Qty

Reject
Qty

Reject
Number

Insp.
Stamp

120

QC6- Inspect dimensions to drawing

0.00

120

QC

Quality Control

Memo

SCRAP unusable 8/15/11

0.00

POSITIVE RECALL

EFFECTIVE 8-02-09 AUTH U

RELEASED _____ DATE _____

130

Identify as per dwg & Stock Location: _____

0.00

130

Packaging

Memo

0.00

Packaging

LOCATION :HALL

140

QC21- Final Inspection - Work Order Release

0.00

140

QC

Quality Control

Memo

0.00

SU 20151111

July-09-15 10:22:01 AM

Work Order ID: 134573

Parent Item: D6021-125

Parent Item Name: Crosstube Material - 17-4Ph SS

134573

D6021-125

Start Date: 7/09/15**Required Date:** 7/21/15

Start Qty: 2.00

Required Qty: 2.00

Comments:

ipp rev:a new issue - prelim LL 12.05.04
15.03.19 DWG REVA DD VERF:JLM

IPP REV:B

Component Item ID/ Item Name	Replacement Item ID	Mfg/ Purch	Bin Item	Primary Location	Last Location	Route Seq ID	Unit of Measure	Qty on Hand	Qty per Kit	Total Qty	Qty Issued	Date Issued	Status
D6021-125P		Purchased	No				Each	0.0000		2			

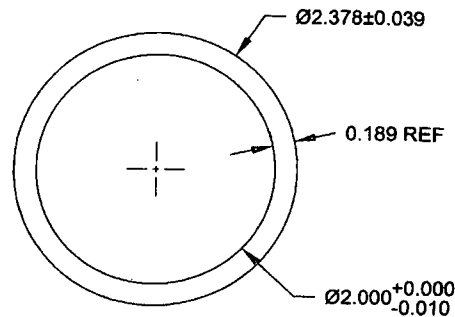
D6021-125P

Crosstube Material - 17-4PH

**

2x SP 15-08-14

SPECIFICATION CONTROL DRAWING



NOTES

1) D6021-XXX CROSSTUBE
LENGTH

WHERE XXX IS LENGTH IN INCHES
EG. 125" LONG TUBE: D6021-125

2) MATERIAL: 17-4PH SEAMLESS STAINLESS STEEL TUBE PER ASTM A564
Ø2.378 O.D. x Ø2.000 I.D.

HEAT TREAT TO H1025 (HRc 34-42):
MIN. ULTIMATE TENSILE STRENGTH = 155 ksi
MIN. YIELD TENSILE STRENGTH = 145 ksi

3) TOLERANCES ARE AS FOLLOWS:
ECCENTRICITY: 10% (+/-0.018" WALL)
LENGTH: XXX +0.500"/-0.000"
STRAIGHTNESS: 0.012" DEVIATION / 12" LENGTH

4) ALL DIMENSIONS ARE IN INCHES

5) TUBE MUST BE PICKLED OR ELECTROPOLISHED TO BE SMOOTH AND FREE FROM SCALE.
6) EXTREME CARE MUST BE TAKEN TO PROTECT THE OUTSIDE SURFACE OF THE TUBE. THE OUTSIDE SURFACE MUST BE SMOOTH AND FREE FROM SURFACE DEFECTS SUCH AS SCRATCHES, NICKS, OR DENTS. DEFECTS UP TO 0.005" MAY BE BLENDED OUT LONGITUDINALLY. CIRCUMFERENTIAL GRIND MARKS ARE UNACCEPTABLE.

WLO 134573

RELEASEE

2015 MAR 18

ECN 15-547

A	NEW ISSUE		CP	15.01.20
REV.	DESCRIPTION		BY	DATE
DESIGN				
DRAWN				
CHECKED				
MFG. APPR.				
APPROVED				
DE APPR.				
DATE	15.01.20			

DART AEROSPACE LTD
HAWKESBURY, ONTARIO, CANADA

DRAWING NO. D6021
REV. A
SHEET 1 OF 1
TITLE CROSSTUBE MATERIAL
SCALE NTS

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Dart Aerospace Ltd.
1270 Aberdeen Street
Hawkesbury, ON K6A 1K7
Tel: 613 632 9577
Fax: 613 632 1053

PURCHASE ORDER

Purchase Order ID **PO29073**

Purchase Order Date 7/09/15

PO Print Date 7/09/15

Page Number 1 of 2

Order From :

VU-HDH001

Ship To : DART AEROSPACE LTD

HDH INSTRUMENTS, LP
3166 HWY 359N
P.O. BOX 709
PATTISON, TEXAS 77466

1270 ABERDEEN
HAWKESBURY, ON K6A 1K7
CANADA

Contact Name

Vendor Phone

Ship To Contact

Ship To Phone

Ship Via:

Journey Freight collect

Ship Acct:

Buyer

Linda Lacelle

Customer POID

Customer Tax #

10127-2607

Terms

Net 30

Currency

USD

FOB

Destination-Collect

Line Nbr	Reference Vendor Part Number Line Comments Delivery Comments	Description/ Mfg ID	Req Date/ Taxable Promise Date	CD	Req Qty/ Unit of Measure	PO Unit Price	Extended Price
1	D6021-125 P B134573 PER DRWG D6021 REV.A HEAT TREAT TO H1025 (HRC 34-42) MIN. ULTIMATE TENSILE STRENGTH = 155KSI MIN. YIELD TENSILE STRENGTH - 145KSI TOLERANCES ARE AS FOLLOWS: ECCENTRICITY:10% (+/-0.018"WALL) LENGTH = XXX +0.500"/-0.000" STRAIGHTNESS:0.012" DEVIATION / 12" LENGTH	Crosstube Material - 17-4Ph SS	7/21/15 Yes 7/21/15		2.00 Each	\$2,000.00	\$4,000.00

Line Total:

\$4,000.00

Note:

7/09/15

Linda Lacelle

From: Nigel Forbes
Sent: July-08-15 9:25 AM
To: Linda Lacelle
Subject: RE: 17-4 tube

I suggest two for validation, please

From: Linda Lacelle
Sent: July-08-15 9:23 AM
To: Nigel Forbes
Subject: FW: 17-4 tube

Nigel?

From: Greg Hovas [<mailto:ghovas@hdhinst.com>]
Sent: July-08-15 9:20 AM
To: Linda Lacelle
Subject: RE: 17-4 tube

Linda

I'll go ahead and quote supplying material on the 2 and 5 pcs quantities. My main concern is that I would not want to supply material if we were processing the larger quantities down the road.

1 or 2 pcs would be \$2000 ea. 5 pcs would be \$1800 ea.

Regards,

Greg Hovas
281 375-6837

DAK 28.3
83583
7F
035

H.D.H. Instruments

Precision **HONING** *Guaranteed*
MACHINING
and
DEEPHOLE DRILLING

From: Linda Lacelle [<mailto:llacelle@dartaero.com>]
Sent: Wednesday, July 08, 2015 6:07 AM
To: Guy Brown (gbrown@aerovacalloyforge.com)
Cc: Greg Hovas
Subject: FW: 17-4 tube

Good Morning Guy,

The Airbus contract is looking good! Would you want to quote on the material for these initial test pieces? H.D.H can supply for one, but not for more. Please let me know if you want to quote on 2 or 5 pieces, per our spec, to be delivered to H.D.H, for processing to the exact size.

Thx

Linda

From: Greg Hovas [<mailto:ghovas@hdhinst.com>]
Sent: July-07-15 5:19 PM
To: Linda Lacelle
Subject: RE: 17-4 tube

We prefer not to supply the material. We can do it for a test pc but if we are going to process more than one we would prefer that you supply the material. If we quote the processing only (you supply material), our price would be \$1000 ea. Thanks.

Regards,

Greg Hovas
281 375-6837

H.D.H. Instruments

Precision **HONING** *Guaranteed*
MACHINING
and
DEEPHOLE DRILLING

From: Linda Lacelle [<mailto:llacelle@dartaero.com>]
Sent: Tuesday, July 07, 2015 4:01 PM

To: Greg Hovas
Subject: Re: 17-4 tube

Thanks Greg. What would the price be for 2 or 5 pls? If these are good, we can still use them for production.
Thx in advance,
Linda

Sent from my iPhone

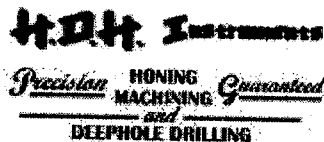
On Jul 7, 2015, at 4:19 PM, Greg Hovas <ghovas@hdhinst.com> wrote:

Linda

Based on buying material and processing 1 pc at 125" long, \$2000 6 work days. Let me know if you would like to proceed.

Regards,

Greg Hovas
281 375-6837



From: Linda Lacelle [<mailto:llacelle@dartaero.com>]
Sent: Tuesday, July 07, 2015 10:39 AM
To: Greg Hovas
Subject: RE: 17-4 tube

Good Morning Greg,
The meetings with Airbus have been going very well, and things are looking promising!! We would like to ask if you could make us a full tube, with the exact spec per our drwg? Not sure if you even have this material, or if you would have to order a min. qty? could you please let me know asap?

Thanks!!
Linda

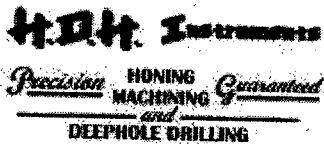
From: Greg Hovas [<mailto:ghovas@hdhinst.com>]
Sent: May-22-15 8:58 AM
To: Linda Lacelle
Cc: HDH Shipping
Subject: RE: 17-4 tube

Linda

We have completed the test piece. Please give me the proper ship to address. We will use the FedEx Account that you provided and ship P1 overnight.

Regards,

Greg Hovas
281 375-6837



From: Linda Lacelle [<mailto:llacelle@dartaero.com>]
Sent: Wednesday, May 20, 2015 8:19 AM
To: Greg Hovas
Subject: RE: 17-4 tube

Hi Greg,

Didn't want you to stay awake at night thinking about this lol! I have already told our directors that you would want to start off with the 2.75"OD, and if you felt comfortable, you would try the 2.50"OD after.

"they would like to start with 2.75" OD, then if they are confident, go down to the 2.50"OD for the raw extrusion, once they go to the 2.5"OD, the price comes down"

So no worries on our end.

Thx

Linda

From: Greg Hovas [<mailto:ghovas@hdhinst.com>]
Sent: May-20-15 9:15 AM

To: Linda Lacelle
Subject: RE: 17-4 tube

Linda

After sleeping on the idea of starting with 2.50" material for this project, I think we need to change it up and say we need to start with 2.75" material. The 2.50" material is simply cutting it too close. Please let me know if this is acceptable on your end.

Regards,

Greg Hovas
281 375-6837



From: Linda Lacelle [<mailto:llacelle@dartaero.com>]
Sent: Tuesday, May 19, 2015 1:20 PM
To: Greg Hovas
Subject: RE: 17-4 tube

Ok, if you can make a sample to our 2.378OD and 2.000ID at 2'-3' long and can use some 17-4 material, this would sure help. When ready, you can ship on our fedex acct # 151793240, P1 overnight. Please let me know if you require any further information.

Thanks again!
Linda

From: Greg Hovas [<mailto:ghovas@hdhinst.com>]
Sent: May-19-15 2:18 PM
To: Linda Lacelle
Subject: Re: 17-4 tube

No problem at all. Give me the parameters and we will get it done as soon as possible. Assuming the same ID and OD sizes quoted. Just give me the length needed.

Thanks

Greg Hovas
HDH

On May 19, 2015, at 1:14 PM, Linda Lacelle <llacelle@dartaero.com> wrote:

Hi Greg,

I just came out of a meeting regarding this, and we are wondering if you could make us a sample? Whether it's from a larger OD, not H1025, maybe a couple of feet long, etc. please let me know.

Thx

Linda

From: Greg Hovas [<mailto:ghovas@hdhinst.com>]

Sent: May-19-15 12:13 PM

To: Linda Lacelle

Subject: RE: 17-4 tube

We would prefer 2.75" OD, but feel confident that we can make good parts starting with 2.50" OD. 2.75" would be the more appropriate size to start with in our opinion.

Regards,

Greg Hovas
281 375-6837

<image001.jpg>

From: Linda Lacelle [<mailto:llacelle@dartaero.com>]

Sent: Tuesday, May 19, 2015 10:56 AM

To: Greg Hovas

Subject: RE: 17-4 tube

Thanks for the clarification. One last question: do you require 2.75" OD to machine this to our drwg, or is 2.50" OD acceptable to work with please?

Thanks again,
Linda

From: Greg Hovas [<mailto:ghovas@hdhinst.com>]
Sent: May-19-15 11:45 AM
To: Linda Lacelle
Subject: RE: 17-4 tube

Linda

Sorry for the confusion. My quote is for the OD machined to 2.375" +/- .039 and the ID machined to 2.000" +0/- .010 per the info on DSC-D6021. The dimensions on the other 2 drawings concern me due to the very thin wall in certain areas. We would have to quote the 2nd 2 drawings provided. However, my original quote is still fine for the 1st item (DSC-D6021). My price does not include the cost of the material. My assumption was that the material would be supplied to us for processing. We would not want to quote the inclusion of material costs on this project.

Regards,

Greg Hovas
281 375-6837



From: Linda Lacelle [<mailto:llacelle@dartaero.com>]
Sent: Tuesday, May 19, 2015 10:33 AM
To: Greg Hovas
Subject: RE: 17-4 tube

Thank You Greg for your prompt response on this! Are you only quoting the drilled tubes, per our drwg D6021-125? Are you are or willing to quote on the OD turning of the tubes?
Please let me know at your earliest convenience.

Thanks
Linda

From: Greg Hovas [<mailto:ghovas@hdhinst.com>]
Sent: May-19-15 11:22 AM
To: Linda Lacelle
Subject: RE: 17-4 tube

Linda

The NDA is attached. Assuming we always run batches of 12 or more pcs at a time, we can quote this work at \$7/inch (125" long pc at \$875). This work is a very good fit for our shop. We take great pride in our ability to manufacture precision tubes. We look forward to working with your company on this project. Thanks for the opportunity to quote this work.

Regards,

Greg Hovas
281 375-6837

<image001.jpg>

From: Linda Lacelle [<mailto:llacelle@dartaero.com>]

Sent: Tuesday, May 19, 2015 6:21 AM

To: Greg Hovas

Subject: RE: 17-4 tube

Good Morning Greg,

Attached are the drwgs for the work we require. If we get the right pricing, we have a potential of a 15 year contract with Airbus. We are looking at 160-240 tubes to start per year, and anywhere between 240-360 tubes per year after this. If you could kindly quote us on both quantities, and quote on the drilled tubes, per drwg D6021 (125" long) and the OD turning of the drwgs D350-748-143 & D350-748-243. I know that our current supplier is purchasing the raw tube from Valbruna at 2.50 OD and machining/drilling the tubes per our spec.

I look forward to hearing back from you.

Thank You,
Linda Lacelle
Manager, Purchasing & ERP
<image003.png>

From: Greg Hovas [<mailto:ghovas@hdhinst.com>]

Sent: May-15-15 4:52 PM

To: Linda Lacelle

Subject: RE: 17-4 tube

Linda

I apologize for being so difficult to get in touch with. The work that I quoted Guy Brown is right in our "wheel- house." Email is probably the easiest way to communicate back and forth. Let me know how we can help you with this project.

Regards,

Greg Hovas
281 375-6837

<image001.jpg>

From: Linda Lacelle [<mailto:llacelle@dartaero.com>]
Sent: Thursday, May 14, 2015 1:22 PM
To: Greg Hovas; Guy Brown
Cc: Derek Dezell
Subject: RE: 17-4 tube

Greg,

Can I give you a call tomorrow or later on today? I am leaving in about 45min. but have access to my emails. Please let me know when it is convenient for you and I will give you a call.

Guy,

Thanks again for all your help! We will definitely be able to work on this together!

Linda

From: Greg Hovas [<mailto:ghovas@hdhinst.com>]
Sent: May-14-15 2:17 PM
To: Guy Brown; Linda Lacelle
Cc: Derek Dezell
Subject: RE: 17-4 tube

Greg will be out for a few hours. If anyone needs immediate assistance please feel free to give me a call.

Thanks Derek
281-375-6820 direct line

Regards,

Greg Hovas
281 375-6837

<image001.jpg>

From: Guy Brown [mailto:gbrown@aerovacalloyforge.com]
Sent: Thursday, May 14, 2015 1:02 PM
To: llacelle@dartaero.com
Cc: Greg Hovas
Subject: 17-4 tube

Hi Linda,

Please give Greg Hovas a call.

<http://hdhinstruments.com/>

HDH does amazing work and Greg is awesome to work with.

I'll send pricing on the bars today.

Thank you

Guy

<image004.jpg>

ISO 9001:2008 and AS9100:2009 Rev. C Registered Company

<http://www.dartaerospace.com/>

Greg Hovas
281 375-6837

<image001.jpg>

17-4 ASTM A564- HT/ H1025- HRc 34-42

2.378" O.D x 2.00" I.D x 123" to 125" long

Qty 300 per year.

Min Ultimate tensile= 155 ksi

Min. Yield tensile strength= 145 ksi

Eccentricity- 10% (+/-0.018" WALL

Length- +.500"/-.000"

Straightness - 0.012" deviation / 12" LENGTH

Tubes must be be pickled or electro polished to be smooth and free of scale.

Outside surface must be smooth and free from surface defects such as scratches, nicks, or dents.

Defects up to 0.005" may be blended out longitudinally

Circumferential grind marks are unacceptable.

Thank you

Guy

Guy D. Brown | Vice President

Aero-Vac Alloys & Forge

1525 E St Gertrude Place, Santa Ana, CA 92705

Phone: (714) 634-4210 Fax: (714) 634-4216

Web: www.aerovacalloyforge.com

Mobile (949) 445-4353

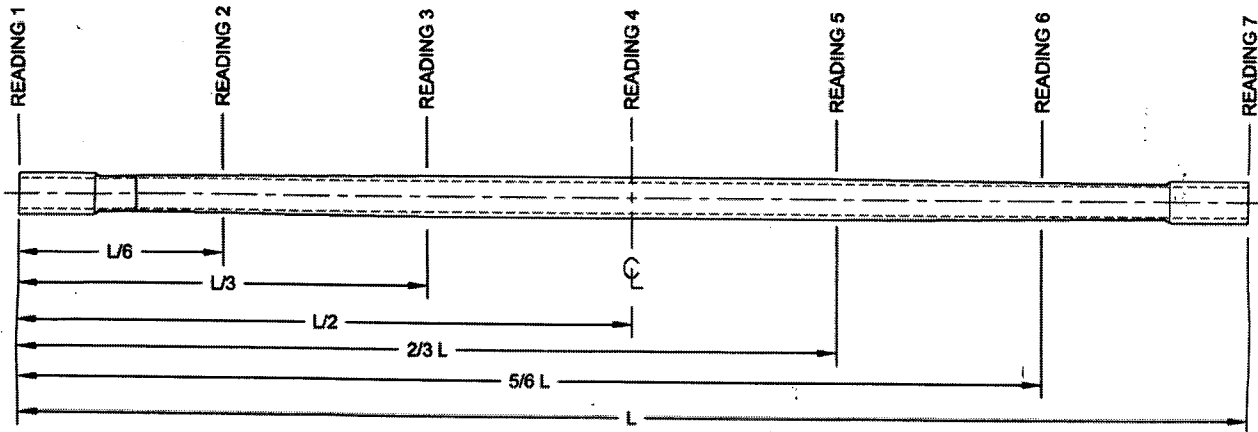
<image004.jpg>

ISO 9001:2008 and AS9100:2009 Rev. C Registered Company

Tube 1

DART AEROSPACE LTD		Work Order:
Description: Crosstube Assembly		Part Number:
Inspection Dwg:	Rev:	Page 2 of 2

WALL THICKNESS MEASUREMENT



Location	WALL THICKNESS MEASUREMENT (IN)				Deviation Δw (max-min)	TOLERANCE
	w1	w2	w3	w4		
READING 1 L= 0"	.211	.214	.212	.210	.004	
READING 2 L= 25	.208	.210	.208	.209	.002	
READING 3 L= 49	.208	.208	.209	.212	.004	
READING 4 L= 74	.211	.210	.210	.212	.002	
READING 5 L= 99	.208	.210	.211	.208	.007	
READING 6 L= 123	.211	.207	.206	.209	.005	
READING 7 L= 148	.210	.209	.212	.201	.010	

Calibration Result

Actual Block Thickness: .142 .500

Sitescan 250 Measured Thickness: .160 .500

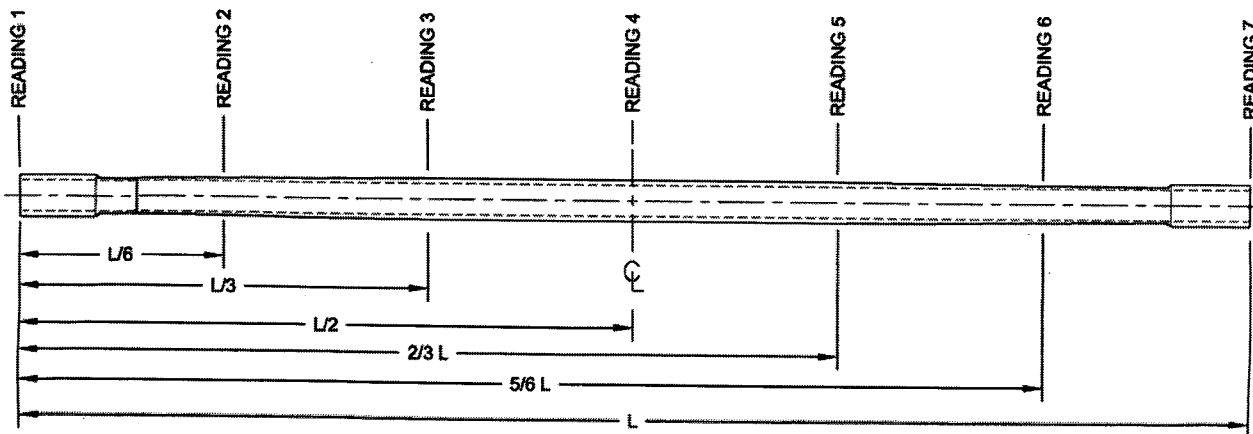
Measured by: <i>mm L</i>	Audited by:	Preliminary Approval:
Date: <i>15/08/18</i>	Date:	Date:

Rev	Date	Change	Revised by	Approved
B	10.04.14	Added preliminary approval	KJ	
C	12.06.01	Wall thickness form added	KJ	

Tube 2

DART AEROSPACE LTD		Work Order:
Description: Crosstube Assembly		Part Number:
Inspection Dwg:	Rev:	Page 2 of 2

WALL THICKNESS MEASUREMENT



Location	WALL THICKNESS MEASUREMENT (IN)				Deviation Δw (max-min)	TOLERANCE
	w1	w2	w3	w4		
READING 1 L= 0"	.213	.214	.210	.207	-.007	
READING 2 L= 25	.208	.210	.209	.210	-.002	
READING 3 L= 49	.209	.210	.210	.210	-.001	
READING 4 L= 74	.207	.209	.209	.210	-.003	
READING 5 L= 99	.211	.211	.210	.210	.001	
READING 6 L= 123	.209	.209	.209	.210	.001	
READING 7 L= 148	.212	.211	.212	.209	.003	

Calibration Result

Actual Block Thickness: .100 .500

Sitescan 250 Measured Thickness: .100 .500

Measured by:	<i>man</i>
Date:	15/08/17

Audited by:	
Date:	

Preliminary Approval:	
Date:	

Rev	Date	Change	Revised by	Approved
B	10.04.14	Added preliminary approval	KJ	
C	12.06.01	Wall thickness form added	KJ	

Tube 1							
Location	w1	w2	w3	w4	w1-w3	w2-w4	max. allow
0"	0.211	0.214	0.212	0.210	-0.001	0.004	0.004
25"	0.208	0.210	0.208	0.209	0.000	0.001	0.002
49"	0.208	0.208	0.209	0.212	-0.001	-0.004	0.004
74"	0.211	0.210	0.210	0.212	0.001	-0.002	0.002
99"	0.204	0.210	0.211	0.208	-0.007	0.002	0.007
123"	0.211	0.207	0.206	0.204	0.005	0.003	0.007
148"	0.210	0.209	0.212	0.201	-0.002	0.008	0.011
Tube 2							
Location	w1	w2	w3	w4	w1-w3	w2-w4	max. allow
0"	0.213	0.214	0.210	0.207	0.003	0.007	0.007
25"	0.208	0.210	0.209	0.210	-0.001	0.000	0.002
49"	0.209	0.210	0.210	0.210	-0.001	0.000	0.001
74"	0.207	0.209	0.209	0.210	-0.002	-0.001	0.003
99"	0.211	0.211	0.210	0.210	0.001	0.001	0.001
123"	0.209	0.209	0.209	0.210	0.000	-0.001	0.001
148"	0.212	0.211	0.212	0.209	0.000	0.002	0.003

O.D.

straightness at 12"

2.403/2.406
2.400/2.403
2.400/2.404
2.404/2.405
2.401/2.403
2.399/2.401
2.406/2.408

.001"

2.405/2.407
2.401/2.406
2.402/2.406
2.401/2.403
2.403/2.404
2.401/2.402
2.402/2.410

.002"